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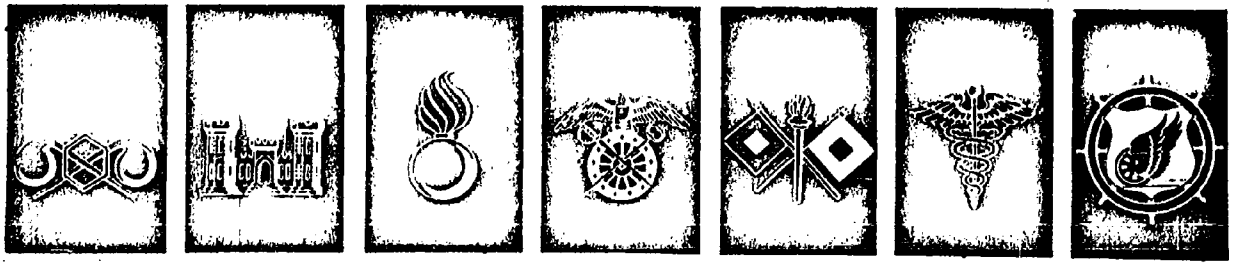

GEN SESSION 1

TITLE: Progress and Prospects in Idiophylaxis (Built-in Individual Self-Protection of the Combat Soldier)

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ABSTRACT: The reliability of a weapons system can never exceed that of its most delicate essential component. More often than not the most delicate essential component of a weapons system is the man who has been trained to use it. Under modern circumstances this man is quite likely to be a highly trained specialist or combat soldier set down in some remote and strange area.

Since our last experiences in the field, there have been exponential expansions in medical knowledge and technology; kaleidoscopic rearrangements of plans and policies; rapid-fire introduction of new weapons, new means of transportation and communication; actual and potential dispersion of forces throughout the world and increasing risks of sudden encounters with hostile climates and environments, including insects, parasites, microorganisms and diseases. All these present ever increasing responsibilities to Army medical research and development and constantly changing and waxing stresses upon the soldiers.

The soldier's reliability, his mental and physical health, cannot be maintained except by a medical research and development program which is scientifically and medically up to the minute and rapidly responsive to the everchanging military needs.

One major goal in such a program is that of giving each combat soldier his medical idiophylaxis (Howie-Sherman) /built-in, individual self-protection/.

The present and future of idiophylaxis will be discussed with particular emphasis on protective mechanisms of the human skin.

ACKNOWLEDGMENTS

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PROGRESS AND PROSPECTS IN IDIOPHYLAXIS
(Built-in Individual Self-Protection of the Combat Soldier)

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All who have been connected with any aspect of military research and development realize that weapons systems generally consist of three main parts: The man, the carrier or vehicle, and the weapon itself. Of these three, man is by far the most complex, most unfathomable and often the most fragile. And, although it may be heterodox to say so to an audience dealing with modern missile systems, tanks, transportation, communication and all kinds of very expensive hardware, I believe that man is also the most valuable military component, especially when trained and skilled in the various specialized crafts and intricacies of modern warfare. And, it is not just a matter of belief but one of record that in military campaigns from antiquity to Korea and Kuwait, the component man is the one that fails the most often. Moreover, he most often fails not because of bullets or missiles or any enemy action, but because of the stresses of climate and food and anxiety and disease.

Let me document this statement with the figures in this table based on the casualty lists of World War II.

(Table 1)

If these figures of World War II astonish you because the man-day losses due to diseases are four times as great as those due to battle injuries and wounds, the best available information indicates that the disproportion in this direction will be even greater in any future campaigns in the remote regions of the world.

We, in the medical service, who are responsible for the effectiveness of the component man are faced with Buck Rogers-Alice in Wonderland advances in technology; exponential expansions of scientific and medical knowledge; kaleidescopic rearrangements of policies and plans; rapid-fire introductions of new kinds of weapons, new kinds of transportation and communication, actual and potential dispersion

of combat and special forces throughout all the regions of the globe; and our troops' consequent unbelievably sudden and rapid encounters with new types of hostile climates and environments, new types of animals, poisons, vegetation, microorganisms, virus and other causes of disease. These new conditions bring with them constantly new and constantly waxing stresses upon the capacity of our men to perform with reliability and effectiveness. They also present constant challenges, as well as opportunities for medical and scientific research.

The soldier's reliability, his mental and physical health, cannot be maintained except by a specially-oriented military medical research and development program which is directly geared to every advance of science and at the same time rapidly responsive to the everchanging military needs. The statement, self-evident though it is in relation to other military research and development programs, such as those in Ordnance, Signal, Transportation, Engineering, and the like is not quite so self-evident and requires a bit of explanation when it is applied to medical research and development. For medicine--the science and the art of preventing, alleviating or curing disease and disability--would, on casual consideration, appear to be the same, whether it is to be applied to the man in or the man out of uniform. However, this is not the truth. All of us are kept fully aware of the billions of dollars which are being spent on civilian medical research; each of us is contributing to these out of his own pocket, not only in the form of taxes to support the programs of Federal, as well as State and municiple governmental agencies, but also in contributions to private hospital and medical school drives, marches of coins, cancer, heart, and mental retardation crusades, and so forth. But, despite the many vast and varied programs of civilian medical research, there remain medical problems which are not now and will not in the foreseeable future be investigated by any civilian agency with a vigor commensurate to the magnitude and immediacy of the threats they pose to our Army's successful operations. These are the medical problems which are the clear-cut obligation of the Army's Medical Research and Development Command.

I shall here recount just one example. In a recent test, 41 of our men were divided into two similar groups. One of these groups was trained, and in addition, acclimatized to heat while at Fort Knox in the United States. The other group was trained at Fort Knox at the same time and in precisely the same way but not heat-acclimatized. Both were then set down simultaneously in tropical Panama and put through the same military exercises and stresses. As had been expected and hoped, the heat-acclimatized men resisted the tropical heat and humidity much better than the men in the non-acclimatized group. In the 20 non-acclimatized men there were 10 casualties due to heat; while in the previously acclimatized group there were none. Moreover, the heat-acclimatized men were able to carry out a substantially greater amount of work in the heat. For example, in a load-

moving task during a 90-minute period the acclimatized group were able to move 11,200 pounds more of water than the non-acclimatized group. Table II shows the breakdown in pounds per man in each of the three 30-minute periods in which the two groups were moving the buckets of water.

(Table II)

But, in contrast to these expected and desirable results, an undesirable finding was that on the morning of the third day, 32 of the total of 41 men had blistering feet. The blistering occurred in 16 men in each group and was of equal severity in both groups; 4 men in each being incapacitated by the blisters.

Now blistering of the feet certainly affects both civilians and soldiers. But, while it is usually just a disagreeable and perhaps somewhat painful inconvenience to civilians, as a source of military incapacity severe blisters on the feet can result in the loss of a battle, a campaign, a cause. There is, therefore, an absolute mandate for military medical research to study intensively the factors and mechanisms which cause blistering--and how to prevent or minimize their effects in soldiers. This fact is supported by the figures of World War II showing that blistering dermatoses caused the loss of over 4 million man-days in the United States Army alone; and that in the British Malayan campaign in 1954-1955** the incidence of new cases of skin disease was about 1000 per thousand men per annum, and represented the largest single cause of admission to the hospital (46 per thousand per annum). At this point I would like to emphasize that in the present state of our lack of knowledge, research into the causes of blistering must go all the way from the most basic types of scientific, physico-chemical, biological, mycologic, bacteriologic, immunologic, and clinical research up to and including almost purely applied research and development in combination with other technical services, such as the efforts to discover and supply our men in the tropics with better boots, better socks, better formulas for foot powder, and generally better clothing and gear.

While it is true that incapacitating skin diseases, including blistering, are the fourth major cause of disability in our Armed Forces, I have cited them here not because of this but because they seem to me to be such convincing examples of conditions which are unequivocally military problems even though the same conditions affect also the civilian population.

In the diagram shown in Figure 1, I give my purely personal and approximate estimates of the probable relative military and

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**Archer, T.C.R., Major, RAMC; Journal of the Royal Army Medical Corps, Vol. 104, No. 1, p. 1, January, 1958.

SCHEMATIC ESTIMATION OF RATIO OF MILITARY AND REQUIREMENTS USEFULNESS AND APPLICATIONS OF BOTH BASIC AND APPLIED MEDICAL RESEARCH IN VARIOUS FIELDS AND DISEASES

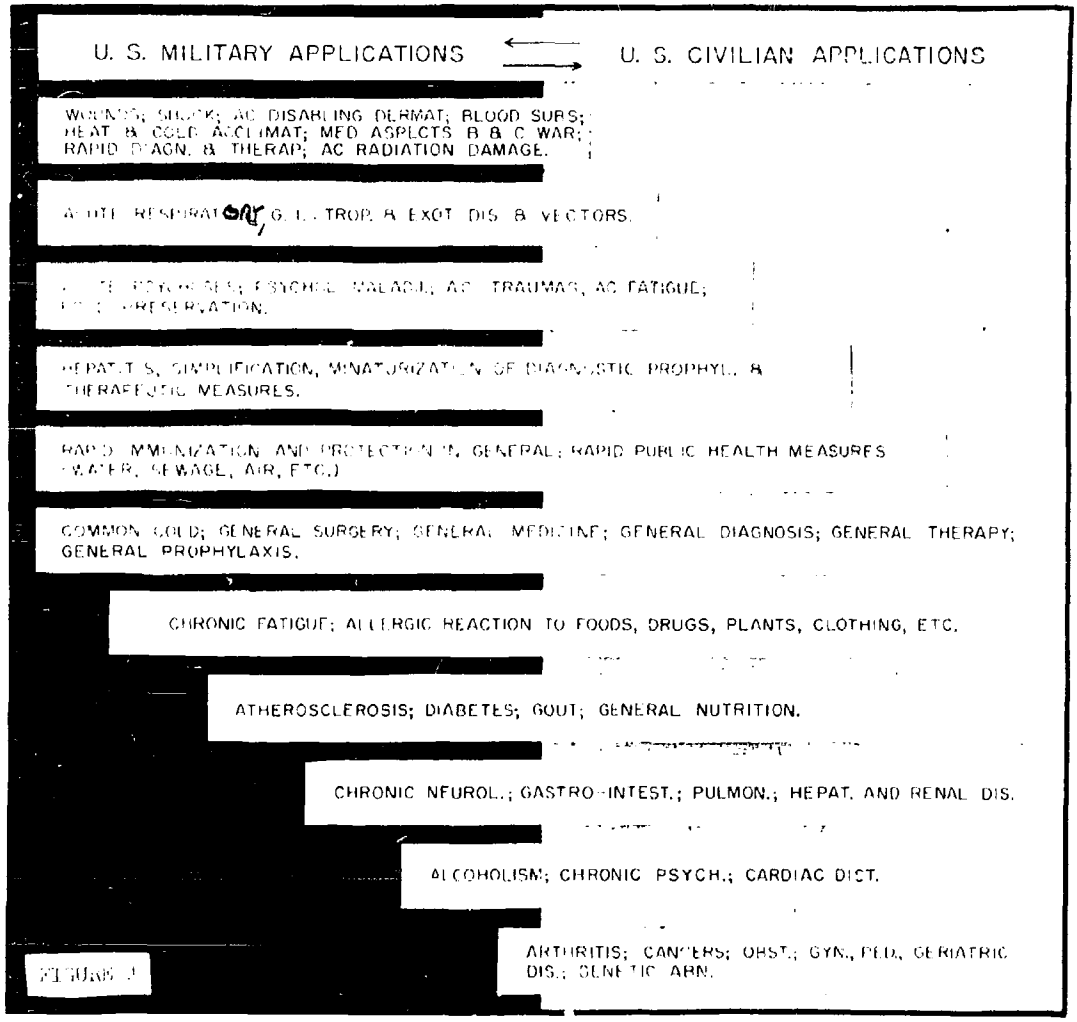

FIGURE 1

civilian importance of some other common medical problems. You will note that many problems that loom so large in the programs of non-military medical research do not figure prominently among those which I consider important to the United States Army (cancer, arthritis, chronic psychoses, alcoholism).

But the common problems which I have placed high on my list do constitute a most back-breaking and possibly disastrous burden in any future military operations. How great this burden in personnel and in logistics has been in the past is strikingly illustrated by the figures for which I am indebted to Colonel Vorder Bruegge, of our Command, as shown in Table III.

(Table III)

Perhaps the best way to bring about a substantial reduction in personnel and logistics requirements is, of course, by individual preventive medicine--by endowing each soldier entering a combat zone with his own in-built capability to protect himself against the prevalent diseases, stresses, climate and other on-slaughts.

The improvement and strengthening of the combat soldier's in-built self-protection by medical means is one of the central objectives upon which the United States Army's research and development program is focused. In discussing this program, Lt Col Donald Howie, Lt Col Jacques Sherman and I have given the name "idiophylaxis" to this form of protection--deriving the term from "idio" meaning self and "phylaxis" meaning protection, a neologism which is analagous to prophylaxis, anaphylaxis and similar terms in common usage in medicine.

Under idiophylaxis we do not include the protective devices which are supplied to the soldier to wear or to use in the form of such things as body armor, bullet-proof vests, anti-mine boots, water-repellent clothing, arctic suits, crash helmets, anti-flash goggles, insect netting, insect repellent creams, and so forth. We do include under idiophylaxis every form of protection that can be given to the soldier by preceding mental and physical preparation through medical means. Thus, idiophylaxis includes the mental conditioning, the immunizing procedures, the chemoprophylaxis, the medicaments and antibodies which we can cause to be embodied in the soldier's own person. It includes every protective capability with which we can medically endow him so that were he to be stripped suddenly naked, he still would carry substantial degrees of protection with him.

Mental conditioning, i.e., psychic idiophylaxis has been placed at the very top of my list because of the high priority which must be given to endeavors to equip our soldiers with the mind and the will to resist the terrible stresses which modern warfare brings with it. We must reduce his susceptibility to excessive fatigue and confusion, anxiety and mental breakdowns. Unfortunately, I shall not have

time to describe our very large and vigorous medical program aimed at a basic understanding of the complex functioning of man's mind in order to arrive at practical methods enabling him to support the impact of the war's sounds and sights, its darkness and its lonesomeness. But, I would like to emphasize that every protective measure with which we endow the soldier's body also contributes greatly to his mental idiophylaxis and his effectiveness and confidence. For, when the soldier feels the physical protection which we have been able to confer upon him coursing through his bloodstream or built into his own skin, he knows in his bones that everything has been done to protect him beforehand and everything will be done to help him if he gets into trouble later.

Another, and perhaps the most militarily important field of all, is the idiophylaxis which consists in conferring immunity or heightening resistance to various types of infectious diseases. This is going on continuously with unremitting vigor, and our global effort in this can be divided into three main phases:

1. Gathering from every part of the world information and specimens of diseases which may be encountered there by our soldiers.

2. Research on the causes and carriers of these diseases, their microorganisms and viruses and vectors in laboratory and experimental animals, cell cultures, etc., both here and abroad. And,

3. The endeavor to produce immunizing vaccines of all types and their laboratory tests and finally their clinical assays.

In these efforts the Army's Medical Research and Development Command collaborates closely with our sister services, with the National Institutes of Health, and with numerous other agencies, both on this continent and throughout the world. Moreover, we are lending major support to the Armed Forces Epidemiological Board and its Commissions, the Armed Forces Institute of Pathology, the National Research Council and similar agencies. In addition, many universities and medical schools, not only in the United States but elsewhere, are receiving our support and are assisting us in this program.

The following tables show some of the conditions in which idiophylaxis can now be conferred (Table IV); some in which chemoprophylaxis is possible at present (Table V); and some in which efforts are being made to increase our capabilities in both of these directions (Tables VI, VII and VIII).

These tables indicate not only the great progress which medicine has already made, but how much still remains to be done. And there remain, of course, the practical problems of how to inject so many different vaccines to large numbers of men in short periods of time with the utmost possible safety. In Figure 2, the injection

Injection Gun FIG. 2

gun, developed at the Medical Equipment Development Laboratory at Fort Totten, New York, is able to give immunizing injections to over 1000 individuals per hour, with accurately measured dosages, complete sterility and entire safety and elimination of the danger of communicating hepatitis or other infectious diseases from one infected individual to another. Moreover, with this gun, the personnel required on an immunizing team have been reduced to one half the number of those required with the usual syringe and needle method.

Here in this rather prognostic drawing of the idiophylactic soldier, Figure 3, I have indicated the immunizations and vaccinations against infectious diseases as having been given in the soldier's arm and buttock.

The other ways in which idiophylaxis is being conferred are also indicated, including the heat and cold acclimatization which we believe will now be possible simultaneously in the same person.

There are two points which I realized only after I had seen this finished drawing. One was that although it is to some degree a projection into the future, it does not appear to be nearly as fantastic as a drawing or description of our astronauts of today would have seemed to me only 15 years ago. The second point that I realized is that the majority of the protective capabilities indicated on this drawing have something to do with the protective capacities of the human skin. Perhaps this is why I, an old hand at dermatology, have been particularly interested in these problems. Not only does the skin serve as an accurate index and record of the immune capacities of the individual in the form of its many specific reactions to skin tests, but the skin is also a natural body armor protecting the individual in great measure against many of the on-slaughts of his environment. Thus, its sweat is one of the most efficient heat acclimatizing and cooling devices; its horny layer and melanin pigment among the best protectives against sunlight; its vascular system and its shunts one of the first defenses against cold and freezing; its surface lipid emulsion one of the best plasticizers and water shedders; the secretions of its surface one of the most powerful disinfectants and antibacterial agents; the barrier zone of its epidermis an almost perfect shield against penetration by most poisons. It would seem that the future soldier's increased protection or idiophylaxis would consist in some measure of a medically conferred augmentation of the already substantial inherent capacities of man's skin to resist.

There is reason for hope that this augmentation can be accomplished. For we are already able to give by mouth certain medicaments which become so firmly embodied in the surface horny layer of the skin that it will resist the propagation of disease-producing fungi for long periods of time. And with this principle established, other infections may perhaps be controlled by a similar mechanism.

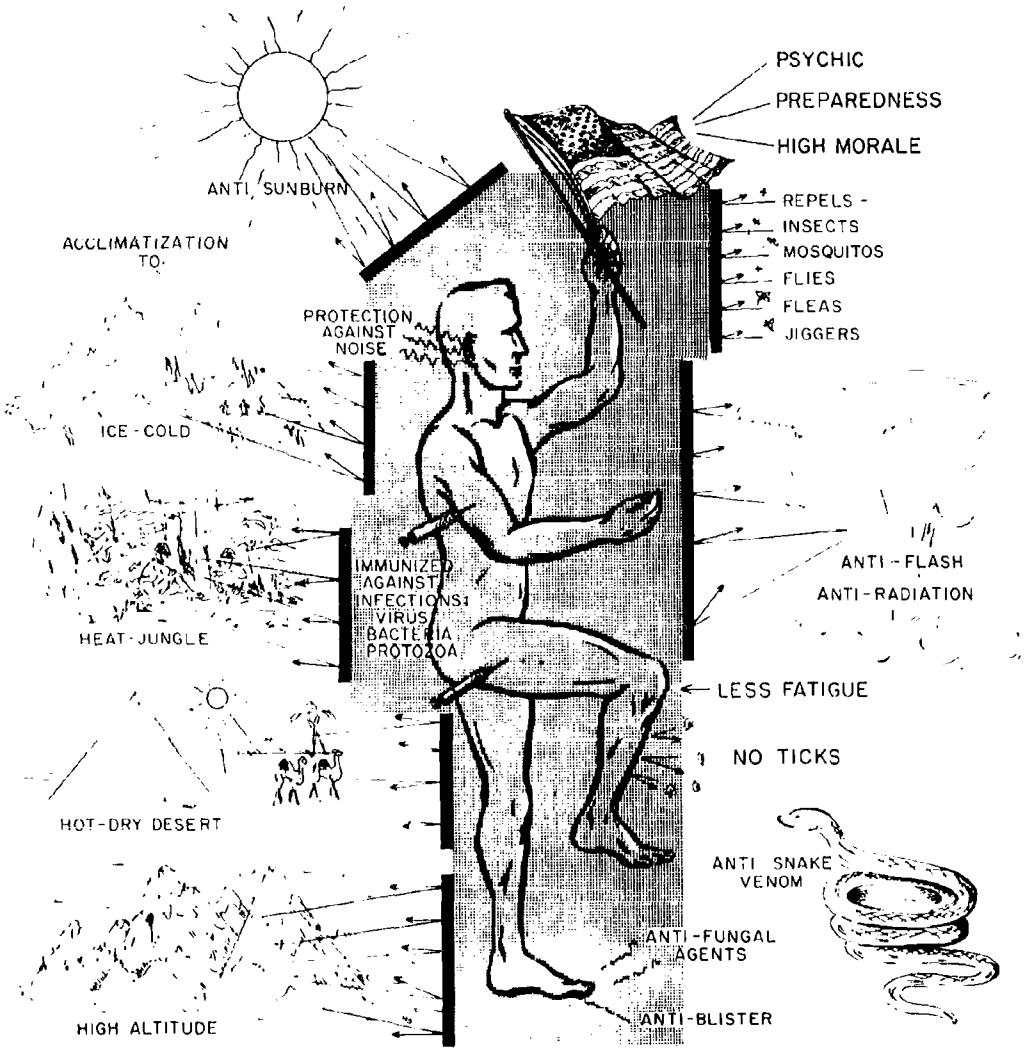

FIGURE 3

IDIOPHYLACTIC SOLDIER

Another promising field for idiophylaxis through the skin consists in the development of the soldier's self-protection against sunlight. While protective creams and protective lotions have long been available, these are difficult and messy to apply, sticky, wash off with sweat and rain, and are effective for very short periods of time. Our goal now is a chemical which will become incorporated in the keratin of the skin's surface and enhance its capacity to filter out the burning rays. There is already one such substance which can be given by mouth, but it has certain drawbacks. We believe that it may be possible to develop in the foreseeable future a better material which on internal administration or when sprayed on the skin's surface will become incorporated in the horny layer and produce a manifold increase in its sun and ultraviolet filtering capacity. Such a protective effect would then resist sweat, washing, rubbing off by clothing, and so forth for many days.

While the prospect is more remote and the problem much more difficult, there is some hope that we may even be able to develop chemicals with anti-thermal effects which will enable the surface of the skin to resist somewhat better than previously the rapid pulse of a flash thermal exposure.

Perhaps more important than any of these will be the development of a material which when incorporated in the skin either after local application or when taken by mouth, would make the skin's surface and its secretions repellent to insects, flies, mosquitoes, ticks, fleas, etc., and other vectors which are the bearers of the most important diseases affecting military operations, including malaria, yellow fever, sandfly fever, hemorrhagic fevers, and so forth. We are devoting a large effort to the discovery of such substances. We already know, for instance, that certain individuals carry with them in their own skin or on their skins' surface and its ingredients chemicals which either attract or repel such insects as biting mosquitoes, flies, bugs, and so forth. We know the exact chemical nature of a few of the most strongly attracting substances, and we have hopes, therefore, of finding some which will act as repellents and which the soldier can then produce in himself and on the skin's surface when given the adequate stimulus. All of you have known people who were particularly susceptible and who attracted insects; and other people who repelled them. It is through intensive study of the differences of the skin and its products in these two classes of individuals that we hope to make progress in the production of idiophylactic insect repellency. This does not, of course, mean that we are relaxing our efforts to discover ways of eliminating insect carriers of disease, or abating in the indoctrination of troops in the best methods of hygiene and personal measures of repellency while we are endeavoring to build into them the idiophylactic measures.

I have mentioned the prospects and efforts in idiophylaxis

against flashburns. While this surely will have to do with increasing the resistance of the skin and the skin's surface, there is a large program of endeavoring to develop better chemoprophylactic measures against the systemic effects of ionizing radiation, so that soldiers will be protected in sufficient measure to go into areas of fallout radiation which are still forbidden to the enemy. While there is no useful product as yet from this program, and none immediately in sight, I believe that the Army research efforts in this direction are well abreast of the most competitive efforts in this field anywhere in the world. Here, again, I must add that our research to confer chemoprophylactic idiophylaxis against radiation, against flash, and so forth, does not by any means interfere with our continued endeavors to discover and supply other protective measures, such as clothing, shelters, shielding and other items of equipment to ward off these damaging effects before they reach man or touch man's skin.

I cannot emphasize too strongly during this discussion of idiophylaxis that we believe that the summation of the effects of in-built self-protection plus all of the adequate equipment and protective devices which can be supplied to ward off damaging agents before they reach the individual will together offer the greatest promise and the greatest reduction of personnel and logistic burdens. While no one would be so naive as to think that research and development in the field of biological sciences and medicine would require the same magnitude of funding as the development of a large intercontinental ballistic missile system, a new type of super bomber, a nuclear submarine, and so forth, we do believe that a substantial increase and a substantially expanded military medical research and development program is needed, and the best possible investment, and that these facts are inescapable conclusions from the data which I have just presented.

In closing, I would like to assure you that we in the medical service are not so starry-eyed as to think that we will ever be able to confer upon the soldier a degree of idiophylaxis which will protect him against all of the attacks of nature or of an enemy, or to make his skin so tough that it will ward off bullets and flames, blast and all radiation effects. However, we do believe that we must develop the idiophylaxis of our soldiers to the utmost degree possible, and that we have every prospect of making him in this way the most effective and most resistant of all human beings and thus reduce the vulnerability of the most delicate component of our weapons systems--the trained man. If we succeed in this, we will all be rewarded, not only by the production of a more effective Army with the highest possible morale, but also by the happy medical yield of discoveries which will contribute to the reduction of disease and suffering, not only in soldiers, but in all mankind.

What this may mean for the health, welfare and strength of our nation has been well expressed in the opening sentence of

SULZBERGER

President Kennedy's message to Congress on February 27th, 1962, just a day after I had submitted my outline for this presentation. "The basic resource of a nation is its people. Its strength can be no greater than the health and vitality of its population. Preventable sickness, disability, and physical or mental incapacity are matters of both individual and national concern."

TABLE I

Personnel Losses from Disease and Battle Injuries or Wounds
(Based on Average Strength of 6,300,000 for US Army in WW II)

Average Number of Noneffectives each Day

Disease	190,386
Battle Injuries or Wounds	48,699
Total	239,085

Equals a Loss of

14 full-strength divisions

(11 because of disease; 3 because of battle injuries or wounds)

TABLE II

LOAD-MOVING TASK PERFORMED BY HEAT-ACCLIMATIZED GROUP AND NON-HEAT-ACCLIMATIZED GROUP IN POUNDS PER MAN

Group	Periods		
	1st 30 Min.	2nd 30 Min.	3rd 30 Min.
Acclimatized	920 lbs.	1110 lbs.	1130 lbs.
Non-acclimatized	770 lbs.	900 lbs.	720 lbs.

(N.B. Both groups improved in second period through learning, but only acclimatized group sustained improvement through third period.)

TABLE III

Costs and Logistical Burden of Disease, Nonbattle Injury, and Battle Injury or Wound
(Calculations Based on Figures of WW II)

500,000 Troops Overseas (Require within 90 days)

25,000 Hospital Beds

28 Engineer Battalions or

21,000 Engineer Troops

working 1.5 months

65,000 Short Tons Material

28,500 AMEDS Personnel

2,100 MD's

23,100 KW Power

3,000,000 Gallons Water Per Day

TABLE IV

Idiophylaxis Now Conferrable by
Immunologic Measures (Vaccines, etc.)

Adenovirus Resp. Inf.	Paratyphoid A & B	Rocky Mt Spotted Fever
Cholera	Plague	Smallpox
Diphtheria	Measles	Tetanus
Epidemic Typhus	Mumps	Tuberculosis (Probably)
Infantile	Q Fever	Typhoid
Influenza	Rabies	Whooping Cough
	Yellow Fever	

TABLE V

Idiophylaxis Now Conferrable by

Chemoprophylaxis (Drugs)

Gonorrhea	Q-Fever
Malaria	Rheumatic Fever
Syphilis	

TABLE VI

Idiophylaxis May Soon Be Available

Anthrax

Botulism

Encephalitides (By certain virus)

Leptospirosis

Rift Valley Fever

Russian Tick-Borne Fever

Tularemia

Heat, Humidity, Cold and Altitude Effects

TABLE VII

Some Examples in Which Idiophylaxis is Required
(Perhaps Possible but not yet Available)

"Common Cold"

Chikungunya Fever

Dengue

Diarrheal and Enteric Diseases

Encephalitides (various)

Epidemic Hemorrhagic Fevers (various)

Fungus Infection (various) (superficial and deep)

Leprosy

O'Nyong-Nyong Fever

Relapsing Fevers (Tick-Borne and Louse-Borne)

TABLE VIII

Some Examples in Which Idiophylaxis is Required
(Perhaps Possible but not yet Available)
(Continued)

Staph and Strep Infections

Wound Infections
Chlostridium
Pseudomonas and others

Parasitic Diseases
(Miscellaneous, worms, flukes, etc.)

Schistosomiasis

Sleeping Sickness

Radiation Damage

Thermal Flash Damage

Fatigue

Battle Psychoses